

City of Beaverton, Oregon

Community Greenhouse Gas Inventory

A consumption-based carbon footprint of residents, businesses and government inside the city of Beaverton for 2006



The Best of Oregon

Overview

This community greenhouse gas (GHG) inventory was conducted to establish the baseline carbon footprint of the entire Beaverton community in order to discover the highest-leverage areas for change and plan long-term GHG reductions.

This analysis provides a *consumption-based* inventory. In other words, these are the emissions associated with consumption by Beaverton households and consumers. The principles of this analysis focus on systems of which the City of Beaverton is a steward, utilize existing capacity and data systems, and inform high-level prioritization of potential actions to reduce GHG emissions. The goal has been to provide the fullest and truest view of the community's GHG emissions.



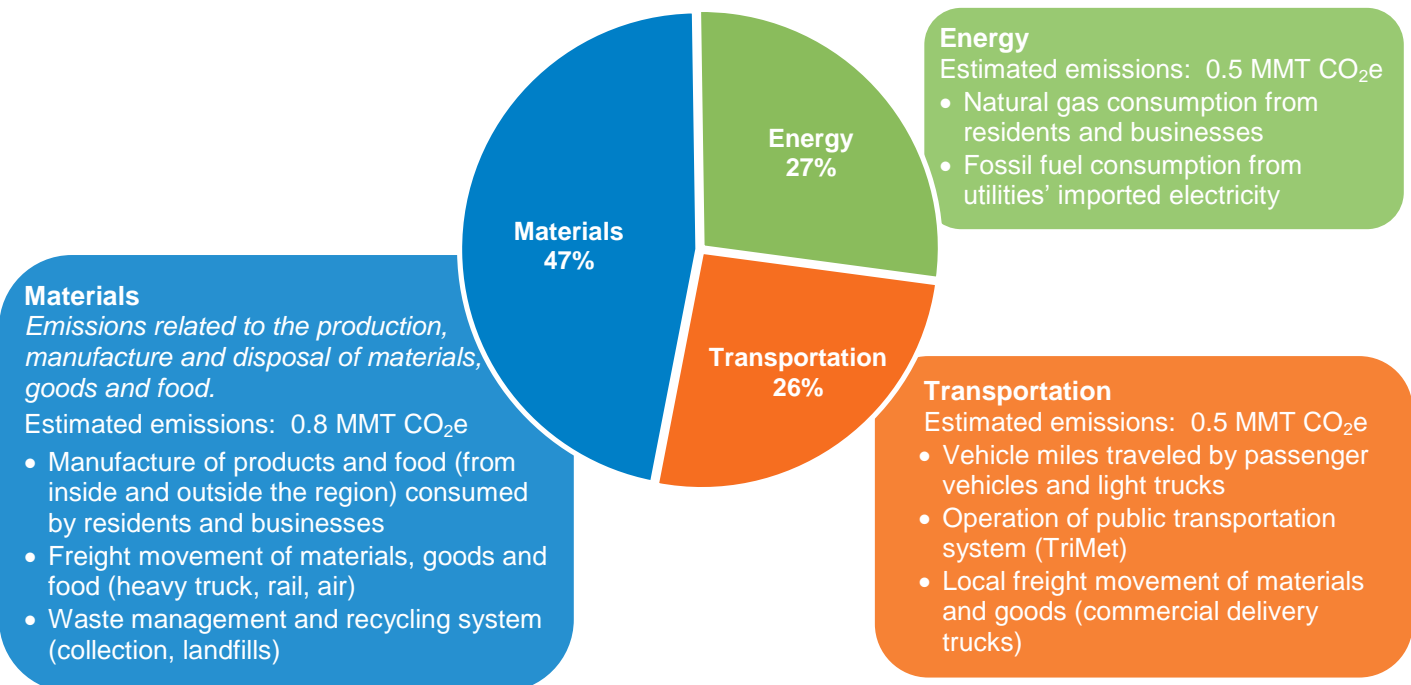
The core methodology of this analysis is based on a 2009 EPA report¹ that uses national data from 2006. It is for this reason that our inventory is also based on 2006 data.

The chart below summarizes, at the highest level, the “carbon footprint” – that is, the greenhouse gas emissions from activities of all kinds – of the citizens and businesses residing within the city limits of Beaverton. Many of these emissions do not actually take place here, but are the result of Beaverton consumer demand. Consistent with a consumption-based inventory, this analysis excludes carbon emissions generated by producing goods and food here for consumption elsewhere.

Beaverton Greenhouse Gas Emissions (2006)

1.8 Million Metric Tons Carbon Dioxide Equivalent (MMT CO₂e)

21.7 Metric Tons CO₂e per Beaverton Resident



¹ "Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices," EPA (2009), http://www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf.



As explained in detail in the following pages, the emissions included in this study are in some cases:

- **Direct** – such as gasoline combustion.
- **Indirect** – from beyond our city and even regional borders (such as electricity imports).
- **Remote** – associated with remote activities that end with final consumption here in the community (such as the production of many goods and much of our food).

Seeking the full carbon picture

This inventory estimates the total carbon footprint of citizens and businesses inside the city limits of Beaverton, Oregon (Appendix A for map); a population which in 2006 included about 83,000 people.

If you've ever seen a *community carbon footprint*, these results may surprise you. Most analyses of the Northwest² as a whole and of cities in the region focus on *direct* emissions from the use of fossil fuels. However, recent EPA research³ suggests that those emissions for which we are *indirectly* responsible—especially those resulting from the production of material goods – encompass a large share of the total, and yet these emissions are ignored by conventional analyses.

There are trade-offs in the approach used here. The calculations related to material flows (goods, food and waste) rely on national data with regional adjustments, rather than on direct measurements. Still, the estimate works: the region's material consumption is not so different from national averages, and the estimate provides a sense of scale with a clear message – consumption of goods and food matters as much as energy and transportation.

It is important to stress that these results are *estimates*, not definitive findings. This analysis builds on recent work to assemble a new kind of inventory, but it is an evolving process based on the state of the data and our understanding of the results. Traditional inventories have focused only on what we could measure *well*.

The goal here is instead to measure where we *can* – and estimate where we can't – the emissions from *all* of our activities and consumption.⁴

Beaverton's role in managing our collective carbon footprint

As a city government with responsibility for transportation and land-use planning, community development and natural resources management and consumption, there are many ways in which the City of Beaverton can provide assistance and leadership in reducing greenhouse gas emissions.

Planning Authority: The City of Beaverton serves as a planner and steward of transportation and land use in the area. Promoting sustainable development is a priority for the City, as is creating opportunities for alternative transportation. This year, the City Council adopted an overarching Civic Plan to address and unite the goals shaped by Beaverton citizens during the Visioning process, goals which include improved connectivity, as well as environmental and economic sustainability.

Community Education and Outreach: The City acts as the leader and educator for sustainability in our community and operates multi-faceted outreach campaigns to educate and provide encouragement to citizens about actions that can impact the livability of our region, from water conservation education to recycling events to the annual "Living Greener" neighborhood summit.

² For example, see "2008 Seattle Community Greenhouse Gas Inventory," City of Seattle, (<http://www.seattle.gov/climate/docs/2008-community-summary.pdf>) or "CO2 Emissions from Fossil Fuels by Sector," Sightline Institute (<http://www.sightline.org/maps/charts/Climate-EmBySector>).

³ "Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices," EPA (2009), http://www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf.

⁴ This analysis is focused on final consumption that happens in residential and commercial contexts. Industrial emissions resulting from the manufacture of goods for export to and consumption by other communities do *not* appear in these numbers, as that inclusion would have produced confusing double-counting. However, there is room for future analyses to provide a complementary set of accounts to look at the carbon footprint of employment and production in the Beaverton region.



Direct Action: The City has completed energy efficient building retrofits, is using federal stimulus grant funds to update street lights with LED technology, offers community garden space to citizens, launched the Solar Beaverton program to facilitate residential solar panel installations and uses “green” infrastructure features in many new construction projects.

What can YOU do?

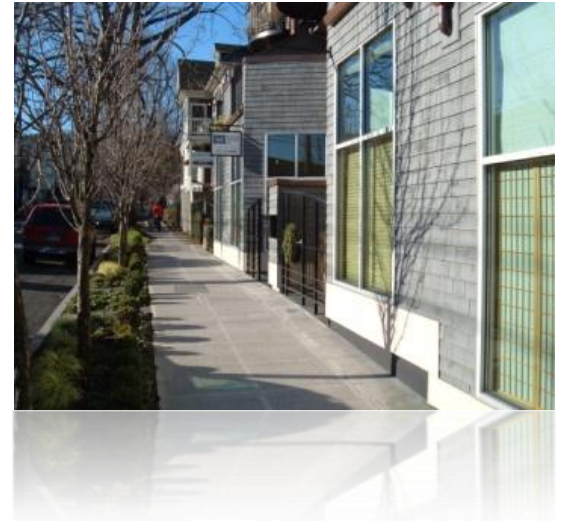
You can find out how your household contributes to greenhouse gas emissions and discover some of the ways you can reduce your carbon footprint. The [Oregon Carbon Calculator](http://www.deq.state.or.us/programs/sustainability/carboncalculator.htm)⁵ allows individuals to estimate direct and indirect greenhouse gas emissions from household transportation, energy use, and consumption of food, goods and services.

About Beaverton and sustainability

Beaverton is a first-tier suburb community located seven miles west of Portland, Oregon, in the Tualatin River Valley. The sixth largest city in Oregon, Beaverton boasts over 100 parks on 1,000 acres, a popular Farmers Market and access to public transit and commuter rail. Beaverton also enjoys one of the most diverse populations among Oregon cities (23% of Beaverton’s population are foreign born, the highest in the Portland Metro area).

The City of Beaverton strives to incorporate sustainable ideals into its municipal operations and throughout the community in order to meet current and future environmental, economic and social needs.

Among recent accomplishments relating to Beaverton’s efforts in sustainability:



- One of just four cities of its size recently recognized as a "Smarter City" energy leader by the Natural Resources Defense Council (2010)
- Recycler of the Year (2008) from the Association of Oregon Recyclers
- Bronze Award Bicycle Friendly community designation by the League of American Bicyclists (2011)
- Environmental Protection Agency's Green Power Community (2007-2011)
- One of the 100 Best Walking Cities in America by Prevention Magazine
- One of the 100 Best Places to Live in America by Money Magazine
- Finalist for the All-America City Award
- One of the Safest Cities in the Pacific Northwest for three consecutive years
- One of the Best Places to Raise Kids by BusinessWeek magazine
- Tree City USA

For more information, please visit www.BeavertonOregon.gov.

⁵ <http://www.deq.state.or.us/programs/sustainability/carboncalculator.htm>

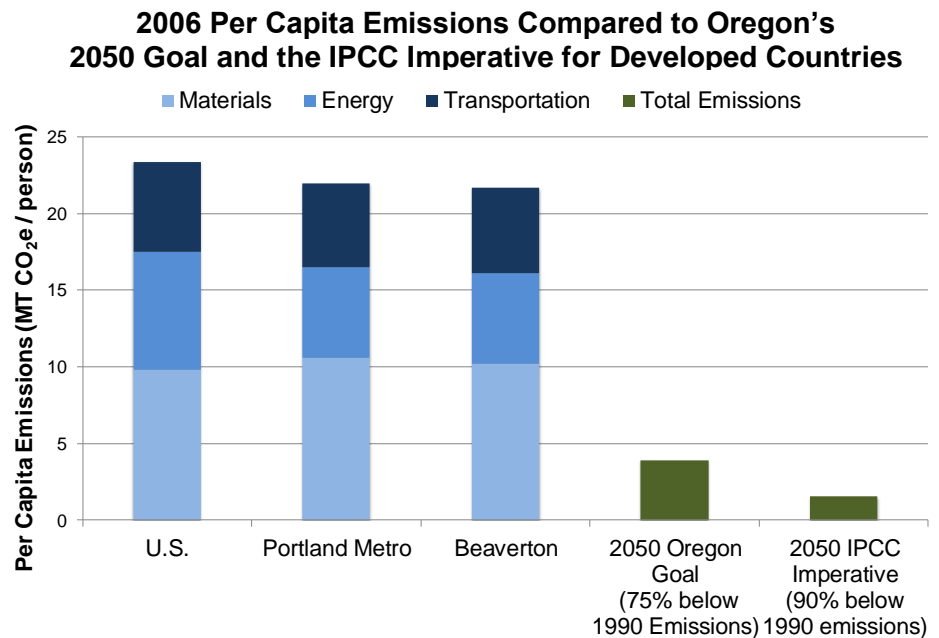


Current emissions and future reductions

Gases that trap heat in the atmosphere are referred to as greenhouse gases (GHGs) or simply as “carbon” in a carbon footprint. These gases are being emitted faster than they can be removed by the Earth’s natural systems, resulting in climatic shifts in both long-term temperature and precipitation patterns. Recent studies⁶ for the state of Oregon say there is a greater than 90% chance that in coming decades, our state will face increases in average annual air temperatures and in the likelihood of extreme heat events. Additionally, changes in hydrology and water supply are likely to occur, including reduced snowpack and water availability in some basins; changes in water quality; and timing of water availability.

This report is overwhelmingly about the carbon footprint of our daily lives here in Beaverton – our transportation habits; our consumption of food and goods; and our use of energy to heat, cool and operate our buildings. One take-away is that this carbon footprint looks a lot like carbon footprints elsewhere in Oregon and in the U.S. This similarity makes sense: our consumption patterns have a lot in common from one place to another in the U.S., and overwhelmingly we’re part of the same fossil fuel-based economy. That said, we are not identical, and the analysis highlights both similarities and differences.

Slight differences do occur. **Beaverton residents have a smaller per capita carbon footprint than the average U.S. citizen**, as can be seen in the figure to the right. This difference is primarily due to two factors: our region’s abundant sources of clean electricity from hydropower combined with lower local transportation emissions from a dense urban area, and higher than average rates of public transit and bike use. Beaverton has a very similar carbon footprint to the Portland Metro region with very slightly lower commercial energy consumption.



Ultimately, although these types of comparison may satisfy our competitive spirits, they don’t tell us how our current emissions compare to the reductions needed to avoid the most catastrophic effects of climate change, as identified by the International Panel on Climate Change, and to achieve the State of Oregon’s identified goals for 2050. While our current per capita emissions nationally, regionally and locally are approximately between 21-24 MT CO₂e per person per year (based on 2006 data), the scientists and policymakers are suggesting that (taking projected population increases into account) we need to be somewhere in the vicinity of 1-4 MT CO₂e per person per year by mid-century.

The general similarity among our emissions means that the suite of climate actions Beaverton needs to employ to reach these large emissions reductions will be the same as elsewhere: fuel efficient vehicles using low-carbon fuels; energy-efficient lighting, heating, appliances and equipment in our homes and businesses; and careful stewardship of material flows to streamline consumption and reduce and capitalize on the wastes we do generate for recycling, energy recovery and composting. This list is the same everywhere, albeit with local twists.

⁶ *Oregon Climate Change Adaptation Framework*, December 2010, developed in partnership with the Oregon Climate Change Research Institute and participating State of Oregon agencies and Oregon University System can be found online at http://www.oregon.gov/LCD/docs/ClimateChange/Framework_Final.pdf



SOURCE-BY-SOURCE SUMMARY OF GREENHOUSE GAS EMISSIONS

Materials, Goods and Food (Production, Movement and Disposal)

Approximately 47% of community GHG emissions are estimated to come from the resource extraction, manufacture and distribution of materials, goods and food for final use and consumption by homes and businesses. A small component of these emissions is also associated with the landfill disposal of food and products at the end of their life. These life-cycle stages – generally out of sight and out of mind – are a large and important part of our carbon footprint, yet are excluded from most GHG inventories.

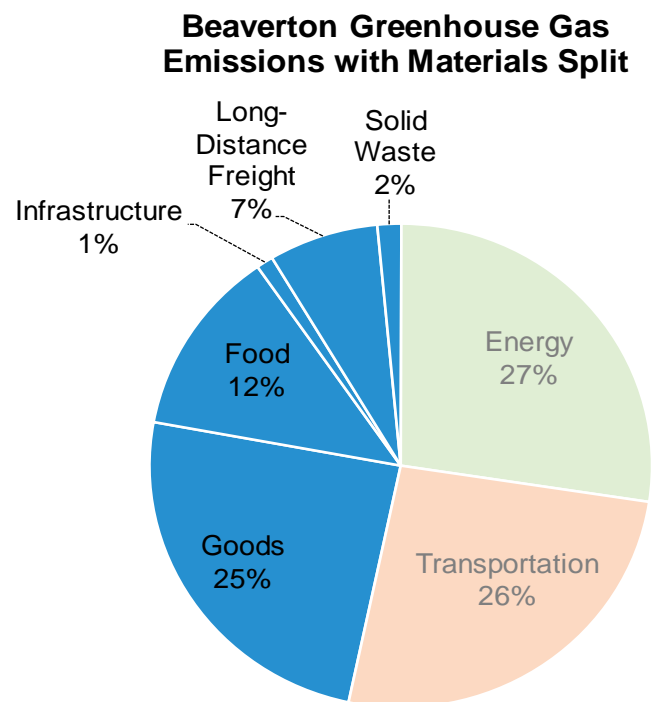
What exactly does this consumption-related carbon footprint include? First and foremost, it is comprised of *products* consumed by Beaverton residents, from clothing and furniture and cars, to food and beverages – shown in the chart below as “Goods” (25%) and “Food” (12%). It also includes packaging and other items that, while often small and largely unnoticed, are single-use and quickly relegated to the waste stream.

The second component of these emissions is the *movement* of goods and food (7%) from remote production sites around the country to Beaverton, quantified here as long-distance freight. This long-distance movement of materials often looms large in our perception, but depending on the item, may in fact be a small slice of the item’s overall carbon footprint. For example, freight-related emissions contribute only one-eighth of the total emissions related to the provision of food⁷. Most food-related emissions result from the growing/raising of food (especially feed for animals) and, to a lesser extent, food processing and refrigeration.

The relatively small solid waste slice (2%) represents the third emissions source related to *consumption*, the emissions associated with the “end-of-life” carbon footprint of goods and food. While this emissions source is a small share of total emissions, two factors should be noted. First, the success of regional waste reduction programs in keeping this slice small should not be discounted. Reuse and recycling that diverts materials from disposal and back into use has significant net carbon reduction impacts compared with use of virgin materials – even when transportation impacts of collection are counted. Second, the management of the more “upstream” portion of material flows offers many potential GHG-reduction opportunities - from promoting new green purchasing strategies for businesses and consumers, to decreasing energy use, to supporting the internalization of the life-cycle carbon costs of goods into their price.

Infrastructure (1%) appears here as well because of the significant emissions associated with the construction and maintenance of highways, streets, bridges, tunnels, sewers and pipelines. Most of this small slice is in the manufacture, distribution and installation of materials into the built environment.

The aggregate estimate for this section (Materials, Goods and Food) does not attempt to include international trade. Estimates of our “imported carbon footprint” suggest that the consumption slice could be significantly larger, increasing our national carbon footprint by as much as 20%.⁸



⁷ *Food-Miles and the Relative Climate Impacts of Food Choices in the United States*, Christopher L. Weber, and H. Scott Matthews Environ. Sci. Technol., 2008, 42 (10), 3508-3513 • DOI: 10.1021/es702969f • Publication Date (Web): 16 April 2008. Downloaded from <http://pubs.acs.org> on March 13, 2009.

⁸ See “Embodied Environmental Emissions in U.S. International Trade, 1997–2004,” Christopher L. Weber and H. Scott Matthews (2007).



Transportation

Transportation is responsible for about 26% of Beaverton's greenhouse gas emissions. These emissions originate mainly from on-road vehicles (commercially and individually owned) and air travel, with small shares from rail, marine and public transit sources.

Transportation activities are clearly an important emissions source, perhaps as much as a third of total emissions nationally, but these activities are diverse. Truly local sources (such as on-road vehicles and transit⁹) total about 14% of total emissions. It is important to note that some of the transportation on which we rely is long-distance transportation of goods from far beyond the community's borders; in this analysis, the emissions from freight movement of these goods is included in emissions associated with material consumption (see page 5), and not within this section of emissions. Only local freight movement is included here.

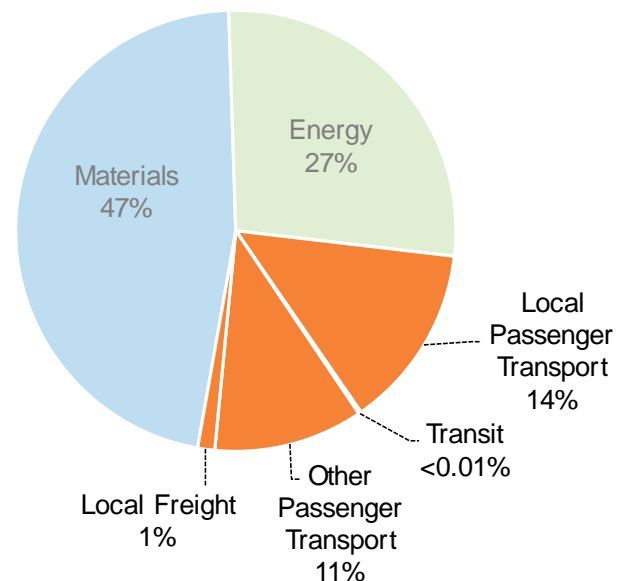
The 11% share labeled "Other Passenger Transportation" consists of air travel and long-distance ground transportation.¹⁰

Transportation, which looms large as a local emissions source, represents a substantial share – perhaps half – of the GHG emissions *that occur here*, in the city of Beaverton. However, when we include all of the emissions resulting from our material consumption – such as those that originate here *and* in remote locations – transportation turns out to be a source of just 26% of the total emissions. These emissions are still sizeable, but not quite on the same scale as our material flows.

As mentioned earlier in this report, typical community analyses often exclude emissions from material consumption. In the Pacific Northwest, this exclusion has the effect of over-inflating transportation emissions compared to energy emissions because our region has a lower emissions factor from energy than does the national mix (see page 7 for more detail regarding energy emissions).

When material consumption is included in the analysis, as it is in this inventory, the share of local transportation emissions falls to less than a third, on par with energy emissions.

Beaverton Greenhouse Gas Emissions with Transportation Split



⁹ Transit refers to TriMet commuter rail and buses.

¹⁰ This analysis uses national per capita averages from the EPA report previously cited, in the absence of local data or explicit guidance from any widely accepted protocol or methodology.



Energy (Natural Gas and Electricity)

Energy used in buildings is the source of 27% of our community's greenhouse gas emissions. Beaverton has two main end-uses of energy (other than for transportation): electricity and direct use of natural gas. Data from the utilities serving Beaverton, Portland General Electric (PGE) and NW Natural, were used for the calculations of each of these major emissions sources.

Building energy use (for lighting, heating and cooling) and the operation of appliances (by residences, commercial establishments and industrial buildings) together account for 0.5 million MT CO₂e.

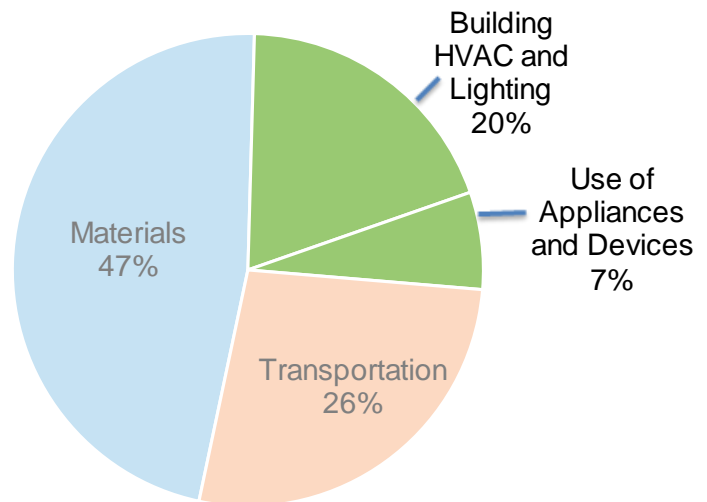
For many long-time residents of the Northwest, it may come as a surprise that electricity consumption is responsible for so much of our carbon footprint. We have traditionally thought of our electricity as clean and green, derived overwhelmingly from hydropower. Yet as the region's economy and population have grown, the system of large hydroelectric dams has not, leaving coal and gas to fill the gap. Renewable energy sources are still a small share (2.1%) of the total, though they are growing rapidly.¹¹

There are many efforts to reduce the region's dependency on coal and gas. PGE has made investments in renewable energy and energy efficiency, and a state-mandated Renewable Portfolio Standard (RPS) will require specific steps in that direction over the coming years. In large part due to public policy and citizen commitment, Oregon has become a leader in renewable energy, including solar and wind. In addition to the increase in renewable energy purchases, the utilities have invested in energy efficiency improvements via the Energy Trust of Oregon.

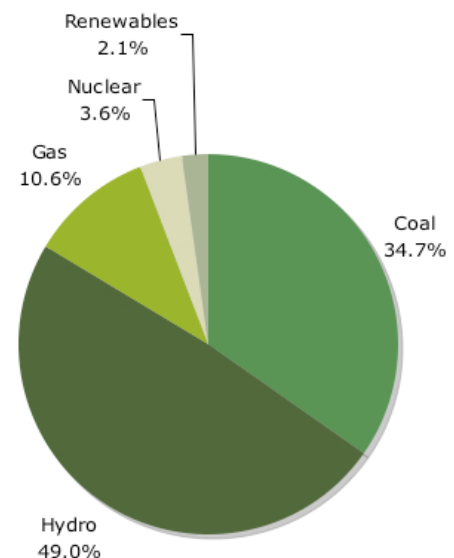
The pie chart at right shows the current mix of energy for the Northwest Power Pool. Large utilities in Oregon are now under mandates to generate 15% of their load from renewable power by 2015, 20% by 2020, and 25% by 2025. Implementation of these standards will result in commensurate reductions in GHG emissions from Northwest power supplies.

Currently, the energy use documented in this section happens almost entirely in buildings, but the distinction between building energy and transportation energy are likely to blur somewhat with the adoption of electric vehicles. While electric vehicle technology promises to lower transportation-related emissions substantially, accommodating this new power demand will require deliberate steps.

Beaverton Greenhouse Gas Emissions with Energy Split



Regional Sources of Electricity
Northwest Power Pool (NWPP)



¹¹ The discussion of the regional electric grid draws on the most recent eGRID data from EPA (<http://cfpub.epa.gov/eGRIDweb/>), which reflects the electric power industry's structure as of December 31, 2007.



Next steps for climate change action

In alignment with the objectives of the City's strategic directions (including Beaverton Community Vision, the Civic Plan, the Urban Renewal plan, and the Mayor's priorities), City staff and consultants will use the information gleaned from this inventory, and from the GHG inventories for City operations, to develop recommendations for creating a sustainability roadmap. The roadmap will incorporate strategies to mitigate the consequences of human impact on the environment while considering economic and social factors, and will strive to institutionalize sustainability in the City of Beaverton.

The City of Beaverton has already initiated many sustainability efforts, such as:

- The Solar Beaverton program to help residents install rooftop solar panels at discounted costs.
- Replacing traffic signals and street lights with high energy efficient LED lights.
- Offering low-interest loans and rebates to citizens for residential energy efficiency upgrades.
- Supporting and encouraging the use of alternative transportation.
- Sponsoring an annual neighborhood summit to highlight sustainable solutions for everyday living.
- Maintaining a community garden program for residents.
- Purchasing renewable energy credits through PGE's Clean Wind and Green Source programs.
- Studying the feasibility of establishing an eco-district in downtown Beaverton.

The City is also committed to:

- Being a leader in sustainability in our community, region and the world.
- Educating and demonstrating sustainable actions and technologies.
- Supporting green business development.
- Reducing emissions from the City fleet.
- Increasing recycling rates and preventing waste in City operations and in the community.
- Making purchasing decisions that minimize negative environmental and social impacts.
- Continuing to practice and promote sustainable building practices.
- Adopting and enforcing land-use policies that reduce sprawl; preserve open space; create compact, walkable urban communities; and protect and foster productive and healthy lands.
- Preserving water resources through education, planning and water supply coordination.

There are also a number of initiatives being pursued by the State of Oregon, including:

- Setting a statewide GHG emissions reduction goal of a 75% reduction below 1990 levels by 2050.
- Developing a low-carbon fuel standard and adapting low-emission vehicle rules. The goal of the low-carbon fuel standard is to reduce the carbon intensity of Oregon's transportation fuel mix by 10% over the next 10 years, by increasing the use of low-carbon fuels such as waste-grease biodiesel.
- Establishing a statewide transportation GHG reduction strategy.
- Adopting greenhouse gas reporting rules for certain industries emitting more than 2,500 MT CO₂e per year including electrical utilities, fuel distributors and landfills.

For more information about the City of Beaverton's green initiatives and how you can take action on the climate change issue, please visit: www.beavertonoregon.gov/green.



Summary of Calculation Assumptions

The core methodology of this analysis is based on a 2009 EPA report¹² that uses national data from 2006. It is for this reason our inventory is also based on 2006 data.

Energy

Assumptions for Natural Gas Emissions:

- Per capita emissions are based on NW Natural retail sales in the City of Beaverton.

Assumptions for Electricity Emissions:

- Per capita emissions are based on Portland General Electric retail sales in the City of Beaverton.

Other details:

- The regional split between HVAC/lighting and appliances/devices was assumed to be the same as the national split.
- Industrial energy use is only the energy used for the operation of industrial buildings, not for the local manufacture of goods and services. The split of industrial energy (separating building operation from product manufacture) comes from the EPA (2009).

Transportation

Assumptions for Local Passenger Transportation:

- Emissions were estimated using a Metro Research Center model, an adaptation of EPA's MOBILE6.

Assumptions for Freight:

- A fixed share (15%) of freight emissions associated with goods and food was assigned to transportation inside the Beaverton boundary.

Assumptions for TriMet:

- Emissions were calculated from TriMet data on electricity consumption for the operation of light rail, diesel and biodiesel for the operation of buses.

Assumptions for Long Distance / Other:

- Per capita assumptions from EPA's analysis were adjusted by the ratio of local per capita income to national per capita income.

Materials, Goods and Food (Production, Movement and Disposal)

Per-capita emissions from material goods and food for the United States attributed to the city of Beaverton, with a few adjustments.

Assumptions for Materials, Goods and Food:

- A certain share (20%) of goods and food production was assigned to the region. Emissions from electricity for that share were adjusted by the region's lower carbon intensity (for the electricity component of production).
- Median household income for Beaverton is higher than the national average. It is assumed that this difference results in a correspondingly higher rate of purchased goods by Beaverton residents.
- The estimates do not account for international trade due to lack of information on foreign production and supply chains, which would (according to several studies) raise the number.

For additional details on this report, please contact:

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Good Company performed this analysis and generated this report, with detailed comments and assistance from City of Beaverton staff.



www.goodcompany.com

¹² "Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices," EPA (2009), http://www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf.



Appendix A: Map of Beaverton City Limits (2006)

